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ABSTRACT

The Montana Systemic Teacher Excellence Preparation (STEP) Project is a National Science Foundation (NSF) Collaborative for Teacher Preparation (CETP), funded in 1993, as an initiative to accomplish systemic change in mathematics and science teacher preparation in Montana. The STEP collaborative uses a team approach to redesign content and methods courses to provide support for mathematics and science preservice teachers. Between 1993 and 1996, 52 courses were revised or created. An evaluation was conducted for program improvement. The 15 STEP coordinators (3 from each of the 5 Montana State Universities) provided early feedback to the evaluator on the assessment plan and instruments to be sure they reflected STEP's goals. Assessments were done in each of the 52 STEP courses, with instructors and students participating, and faculty teams were invited to review and comment on evaluation data. Data from the revised courses were analyzed against the STEP program's "Table One" list of criteria. Information from the surveys, interviews, and observations provided cross-referenced evidence about the use of the Table One Criteria and indicated that STEP was meeting its planned objectives. The evidence builds a strong case that reformed-style instruction is occurring in the STEP courses. An appendix lists the Table One criteria for reformed curricula and teaching. (Contains eight references.) (SLD)

Summary of the Montana STEP Project Approach to Course Reform Evaluation

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Paper presented as part of a symposium, "Approaches to Evaluation of Reformed-Based College Mathematics and Science Courses Funded Through NSF Collaboratives for Excellence in Teacher Preparation (CETP)" conducted at the annual meeting of the American Educational Research Association, San Diego, CA, April, 1998.

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Summary of Montana STEP Project Approach to Course Reform Evaluation

Introduction

The Montana Systemic Teacher Excellence Preparation (STEP) Project is a National Science Foundation (NSF) Collaborative for Teacher Preparation (CETP), funded in 1993, as an initiative to accomplish systemic change in mathematics and science teacher preparation in Montana. The STEP project involves faculty from the Montana University System and tribal colleges; the state Office of Public Instruction; K-12 teachers; the Montana Science Teachers Association (MSTA); and the Montana Council of Teachers of Mathematics (MCTM). The goal of the Montana collaborative was to bring about large-scale improvement in the preparation of K-12 science and mathematics teachers in Montana and to serve as a national model for rural areas with significant minority populations. To this end, the collaborative uses a team approach to redesign content and methods courses in mathematics and the sciences for preservice teachers; creates model teacher preparation field sites in K-12 schools; recruits and supports future Native American mathematics and science teachers; uses Montana's extensive telecommunications network as a key component in the development of teacher preparation models for rural schools; and provides an early career support (mentoring) program for mathematics and science teachers in rural settings during their first four years of service.

A team approach was used to redesign mathematics and science content courses, and methods courses for pre-service teachers. Teams, which include faculty, graduate teaching assistants and K-12 teachers, meet regularly to redesign or create undergraduate courses at five Montana University System campuses. Course reforms are designed to align with research supported "best practices" described in STEP's "Table One: Reform Goals for Mathematics and Science Teaching." This table was constructed collaboratively by a state-wide faculty group, 1992-93. This table, from the original STEP proposal, is the guiding framework for mathematics and science teaching reform. Appendix A contains STEP's "Table One". A total of fifty-two (52) courses were revised or created between 1993 and 1996. *Note: Descriptions of individual course initiatives, arranged by campus, are found in a Course Revision Catalogue available from the STEP project.*

The project was challenged to document progress made in revising the undergraduate courses for preservice teachers. Information was required to inform a variety of people including university administrators, content departments, faculty, project

PI's, campus coordinators, STEP's National Visiting Committee, the NSF and interested others. From the very start, interest in the assessment of revised courses exceeded interest in assessment of other project components (e.g. the K -12 model school sites or an early career teacher mentoring program).

Approach to Evaluation

The assessment plan was an embedded and integral part of the course reform process based on a belief that assessment and evaluation had the potential to make a positive difference. According to *Students at the Center* (Musil, 1992), fifty-two percent of the nation's colleges and universities reported that assessment led to changes in curricula or programs. Faculty members involved in assessment reported that their view of teaching and their activities in the classroom had been affected by involvement in assessment. We embraced a view of assessment that tied it firmly to learning and offered genuine hope for real undergraduate reform. A rich and varied set of assessment methods was planned that would coalesce to: improve rather than prove; view student experience over time; incorporate multiple methods and sources of information; focus careful attention on how information was used; provide occasions to talk about and interpret information; involve faculty members; and involve and listen to students.

The evaluator practiced a participatory approach to assessment and evaluation that involved project leaders and participants in identifying the kinds of information needed to guide the evolution of the program and ensure its success (Patton, 1986; Guba & Lincoln, 1989; Stevens, Lawrenz & Sharp, 1993; Scriven, 1993). She worked with the staff to identify key formative evaluation questions, and provided a continuous stream of formative data to encourage improvement.

Sample questions that emerged included: *Is an expanded group of faculty recruited to the reform process? What faculty beliefs about learning are changed? Do new faculty members and graduate teaching assistants find the course reform team approach helpful as a network to learn about STEP project goals? Are faculty designing and carrying out classroom and program assessments themselves? Is dialogue and discourse helping to define campus action and research agendas for teaching and learning? Is the formal reward system changing in response to a shift in campus orientation to support quality teaching? What is the nature of communication among the faculty, departments, and colleges about course reform?*

Inclusion & Empowerment

Assessment was intended to be a central and cohesive element in the reform process. Faculty members have long practice in making judgments about student work; their expertise in doing so is crucial in deciding what questions assessment should focus on, what the collected data add up to, and what should be done to improve instruction. Since the single most important route to improvement is through the classroom, faculty members in particular were active participants in the assessment process. The assessment was not envisioned as primarily an administrative task, but rather an educational process. The assessment moved from the "inside out" rather than from the "outside in." People knowledgeable about pedagogy, methodology and who were active in the design and development of the project played key roles in the assessment process - project directors, campus coordinators, and faculty members.

The fifteen STEP campus coordinators (three faculty from each of five Montana State University campuses) provided early feedback to the evaluator on the assessment plan and instruments to ensure that they reflected the goals of STEP's "Table One" Framework for Mathematics and Science Reform (see Appendix A). This table, from the original STEP proposal, served as the guiding criteria for constructing assessments and doing the evaluation. Assessments were done in each of the 52 STEP courses. All faculty teams, as well as their students, from the departments of education, mathematics, and the sciences at each of the five Montana University System campuses participated in assessments. Teams of faculty were invited to review and comment on evaluation data and draft reports. Appropriate data and reports were provided to faculty teams and campus coordinators.

STEP Course Revision Catalogue

As the number of courses engaged in the reform process grew, it became increasingly difficult to keep campus coordinators and others informed. In response, a STEP Course Revision Catalogue was created with basic information for each course. The catalogue, arranged by campus, lists the title, rubric/number, education program (for elementary and/or secondary preservice teachers), date revision process began, a brief description of the goals for the reform, and the name of the faculty team leader. This catalogue was helpful to those people interested in knowing what courses were part of the STEP Project and the nature of the reforms.

Collecting Data

Cooperation and input from the course reform faculty at each of the Montana University System campuses was critical. Although it required a significant amount of travel, getting acquainted with faculty and developing a comfortable and productive working relationship was an essential activity in the first project years. Once that had happened, data collection for subsequent years was considerably easier. Communication by telephone and e-mail worked well once a personal relationship existed.

Multiple Data Sources

Using multiple data sources was recognized as important (Worthen & Sanders, 1987; Fetterman, 1988; Frechtling & Sharp (Eds.) 1997). Methods included: (1) semester-by-semester faculty team surveys; (2) visits to reform team meetings; (3) faculty interviews; (4) student interviews; (5) class observations; (6) a survey of all students enrolled in reformed courses Spring Semester 1996, and (7) document review of course syllabi and other instructional materials. Assessments involved course reform faculty teams, as well as students, from the departments of education, mathematics, and the sciences at each of the five Montana University System campuses. Faculty were engaged in instrument design; semester-by-semester surveys; interviews; and class observations. Students regularly contributed to focus group interviews and provided survey and questionnaire responses. The resulting data were analyzed with criteria established in STEP's "Table One" reform goals for science and mathematics education. *Note: Reports and assessment instruments are available from the author.*

Impact

One result of evaluation efforts was a significant increase in university faculty and K-12 teacher participation in course reform evaluation. For example, Montana university system faculty visited each others' campuses and attended reform classes as peer observers. The observations were made within and between the departments of education, mathematics, and the sciences. Also, area K-12 teachers observed revised classes and shared their findings with university course reform faculty teams. In addition, campus coordinators from different university sites visited revised classes at their home campuses and at other Montana campuses.

The STEP project steering committee, with representatives present from each of the university campuses, endorsed the campus peer visit initiative. Although three statewide course reform conferences (1993, 1994 & 1995) had provided important and meaningful opportunities for discussions and interactions among the faculty from the five STEP campuses, the steering committee concluded that on-site visits, where visiting teams would immerse themselves in the reformed learning environment of another campus by attending classes and engaging in focused discussions with their colleagues, would enhance programmatic collaboration of the STEP Project.

Faculty groups interested in learning more about a STEP reformed class or classes at another Montana campus were invited to participate in cross-campus visits. While visits could be arranged for an individual, two or more visitors traveling together from one institution was suggested. New faculty members or faculty members who had not been involved with STEP at each campus were especially encouraged to participate.

Campus visits were arranged for peer faculty with similar course/content interests from different campuses to (1) attend and observe STEP reform courses and (2) participate in focused discussions with STEP reform faculty teams. Teams generally included instructors, graduate students, and K-12 teachers who had worked on one or more course reform effort. Visitors often had the opportunity to attend other STEP campus group meetings or events.

Much was gained by sharing individual faculty team efforts. Often faculty members on separate campuses were working on parallel problems or initiatives. Creating a structure for observations and dialogue between colleagues promoted STEP efforts at each campus. Expanded class observations at all sites: (1) involved more faculty and administrators in documentation of reforms; (2) increased dissemination of reform initiatives; (3) created an information base to educate peers about reforms; (4) supported faculty interactions between campuses (especially for teams working on similar class revisions); and (5) recruited additional faculty at each site. This initiative expanded faculty involvement, interaction and collaboration across the state.

A Judicial Model

In a judicial model, the majority of evidence favors one answer. While there may not be a definitive answer, the gathered information from different sources seems settle on one side. In STEP's evaluation of course reform, data from revised courses was analyzed against "STEP's Table One" criteria. Information from the surveys, interviews and observations provided cross-referenced evidence on the frequency that "Table One" strategies are used in revised classes. Because data provided abundant evidence that STEP strategies from the "Table One" framework are implemented in the revised courses, we came to call this a "judicial" model of evaluation.

The name "judicial" seems appropriate since a preponderance of evidence was gathered and weighed to create a well documented account of the Montana STEP Project's reform process and accomplishments. A strong case was built to support a belief that reformed-style instruction now occurs in STEP revised courses.

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Appendix A

"Table One"

STEP's Reform Goals for Mathematics and Science Teaching

STEP teachers at the colleges, universities and K-12 schools will:

1. Use curricula that show relationships between different fields of science or mathematics, and between science, mathematics and other subject areas, such as social studies or reading/language arts.

2. Actively engage students in inquiry, problem-solving, and model building.

3. Use specific strategies found to be effective in engaging female and minority students, especially Native Americans, in mathematics and science.

4. Recognize the progression in learning from concrete to abstract, providing ample opportunities to work with manipulatives and hands-on materials, and first-hand experiences in laboratory or field settings.

5. Provide regular opportunities for social interaction and group work.

6. Use strategies to identify and build upon students' preexisting ideas.

7. Introduce real world applications of mathematics and science.

8. Use appropriate technologies, including graphing calculators, a variety of computer applications (e.g. modeling, laboratory interface systems), telecommunications networks (e.g. Internet), and video technologies.

9. Use assessment techniques that are challenging, varied and allow students to make some choices about how best to demonstrate their learning.

10. Demonstrate effective management in an active classroom.

11. Promote a culture in which teachers' efforts to promote students' involvement in mathematics and science are actively supported by school administrators, parents and other members.

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